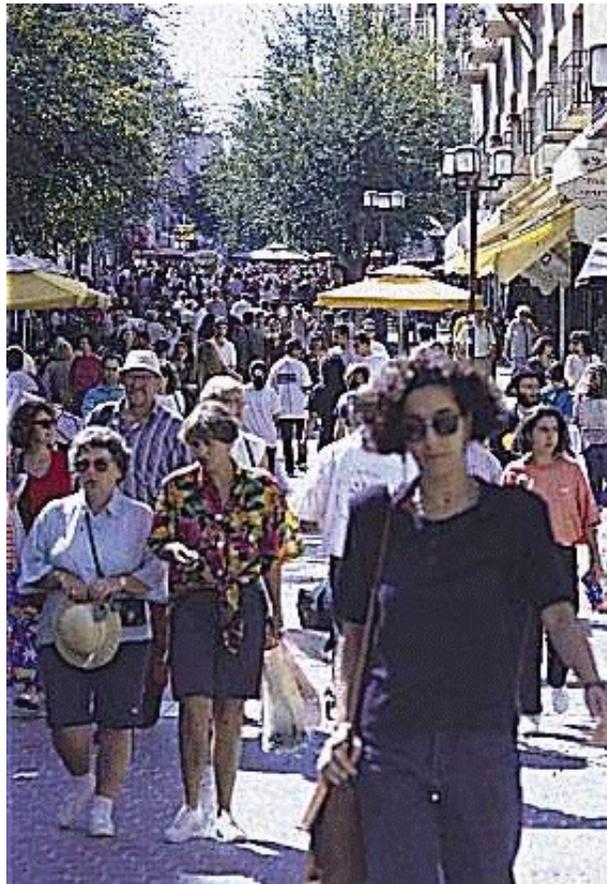


Community Design and Individual Well Being:

The Multiple Impacts of the Built Environment on Public Health

A Narrative Presentation to the Obesity and Built Environment Conference
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Overview

Emerging evidence suggests that many of the ways in which we design our communities impact our health (Srinivasan et al 2003; Frumkin et al 2004). Each of the singular strands of research, whether it be how community design impacts physical activity and body mass index (Ewing et al 2003; Frank et al 2004a; Saelens et al 2003) or how the built environment impacts how much we drive (Ewing and Cervero 2001) and if we have healthy air to breathe (Frank et al 2000a) presents a powerful argument for stronger connections to be forged between currently disparate professional boundaries. Major events such as the *Obesity and Built Environment Conference* are important steps whereby the built environment and public health professions can begin to meld a new lexicon. Moreover, to move towards a collective understanding of how to create new, and how to recreate existing communities, that are more health promoting. Healthy air, physical activity and associated body mass index are just a couple of the ways that community design impacts our health. While perhaps not well understood, other areas include relationships between community design and patterns of social interaction and the formation of social capital, sense of safety and security, mental health, and important aspects of water quality (Frumkin et al 2004). Ironically, planning was borne out of health related concerns at the turn of the 20th Century, and it is these common roots that will help to bring us back together (Frank et al 2003).

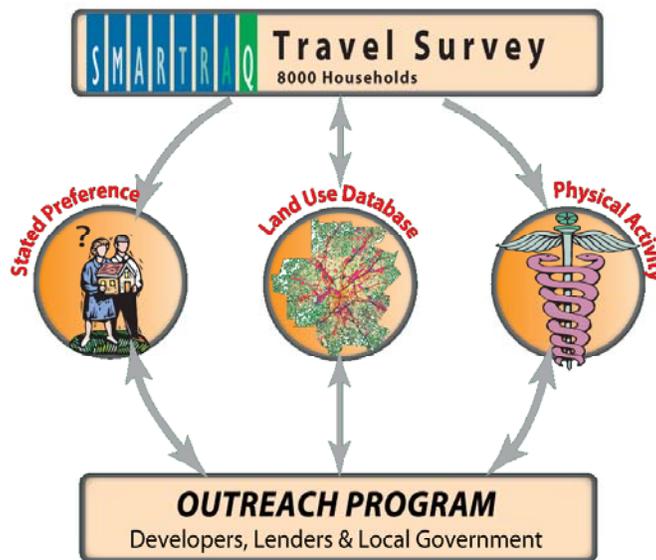
The importance of considering multiple outcomes of how the built environment impacts our health is perhaps best expressed through the findings of some recent research. In our recent assessment of the relationships between the built environment, physical activity and obesity for 10,898 Atlantans, we found that every additional 30 minutes spent in a car was associated with a 3 percent increase in the odds of being obese (Frank et al 2004a). This same study, known as SMARTRAQ, also found that the amount of Oxides of Nitrogen and Volatile Organic Compounds generated by a household that leading to the formation of harmful tropospheric ozone (Boubel et al 1994), a function of the vehicle use, is also associated with the similar measures of street network layout, residential density, and land use mix found to impact body mass index amongst whites (Frank et al 2004a). Therefore, as we begin to dig into the relationships between community design and public health, it will likely become increasingly apparent that taking into account these multiple outcomes will help to explain the variation within individual outcome measures such as body mass index, but also will bring to the table important partners to address much needed public policy responses.

Approach

In keeping with the goals of the *Obesity and Built Environment Conference*, this paper will highlight some evidence-based strategies for intervention and identify some research-based strategies to enhance interagency coordination. In light of the new research that is presented, it will conclude with some notions for future research that may be most strategic. Results are presented from three components of the Atlanta based SMARTRAQ (www.smartraq.net) program. Strategies for Metropolitan Atlanta's Regional Transportation and Air Quality (SMARTRAQ) represent a unique 5 plus year partnership between public health, transportation,

and environmental organizations.¹ The project was initiated by the Georgia Department of Transportation in partial response to the Atlanta region’s inability to demonstrate conformance with the requirements of the Clean Air Act in 1997. Once funding was in place by transportation agencies to address linkages between land use, transportation, and air quality; the Centers for Disease Control and Prevention’s Physical Activity and Nutrition Division chose add to a Physical Activity Module and also to support the inclusion of questions of height and weight, within the larger travel survey of 8,000 households (17,000 participants). The physical activity module includes an in-depth questionnaire on activity patterns, and two sub surveys, one including a global positioning system and electronic travel diary and another including the usage of accelerometers to ensure the objective measurement of physical activity. Figure 1 provides an overview of the study design.

Figure 1 – Conceptual Framework



As a result, agencies across several disciplines leveraged one another’s resources and shared in the cost of data collection and now have the opportunity to partner on the approaches taken to implement the results. A regional advisory committee was formed that included a wide range of interests, such as local governments, the Metro Atlanta Chamber of Commerce, the Urban Land Institute, Sierra Club, and many others. Quarterly meetings were held throughout the 5-year study period where study design and goals, research methods and survey design materials, and project results and findings were presented and reviewed – and views were shared. Through this interactive process, an increased understanding of the perspectives and areas of commonality were identified across disciplinary lines. A panel of experts guided the project from urban transportation, public health, urban planning, real estate, and environmental planning. At the project’s inception the expert panel convened and identified possible additions to the study beyond the scope and resources of the initial Georgia DOT investment of \$1.4 million, including

¹ Funded by the Georgia DOT, Georgia Regional Transportation Authority, Atlanta Regional Commission Centers for Disease Control and Prevention, Environmental Protection Agency, and the Turner Foundation. Total project budget is estimated at \$4.6 million.

a larger sample size for the travel survey and a residential preference survey to gauge the underlying demand for different types of community environments. Additional funding (\$2.4 million) was provided by the Georgia Regional Transportation Authority (GRTA) to add these components to the study through the Congestion Mitigation and Air Quality Program (CMAQ) as an experimental pilot project.

Pursuant to the code of federal regulations, CMAQ projects must produce measurable air quality benefits. To meet this requirement, SMARTRAQ applied the findings of the project to the Atlanta Regional Commission's Livable Centers initiative (see www.atlantaregional.com) and modeled the travel behavior and air quality benefits of proposals to create more walkable communities within the Atlanta Region. This exercise tested several community design interventions through a comparison of building out three communities within the Atlanta Region (Perimeter Center, West End, and Marietta) under the current auto-oriented versus a more walkable pedestrian-oriented design. The results suggest important benefits of adding sidewalk infrastructure, street connectivity, mixed use, and residential and employment density on air quality, promotion of transit and non-motorized forms of travel and air quality. Results of this assessment will be released as part of a final set of reports from the study this summer.

As shown in figure 1, SMARTRAQ included an outreach program, which, between 1997 and 2000 convened 4 major events with area developers, local and national real estate financiers and bankers, and local government officials including two keynote addresses from then Governor Roy P. Barnes. This interdisciplinary effort identified the barriers and best practices to creating walkable environments in the Atlanta region culminated in a report, *Trends, Implications, and Strategies for Balanced Growth*, which can be downloaded at www.smartraq.net. In summation, many of these approaches and partnerships, and research methods presents a model shown in figure 2, that seeks to build off the synergy that is inherent between transportation, the environment, and public health that other regions can adapt.

Figure 2 – Interdisciplinary Collaboration



Research Methods

Study participants were recruited from the 13-county Atlanta region, using a computer aided telephone interview that screened and selected based on household income, household size, and residential density (the number of households per square kilometer) in which the household was located. Phone numbers were obtained through a commercial reverse directory of listed phone numbers and addresses and computer-generated phone number based on area codes. The 13-county region in Atlanta, Georgia has a low proportion of high density, mixed use, interconnected environments that support walking for utilitarian travel.²⁵ Past research shows that the choice to walk vary considerably across these measures of urban form (Sallis et al 2004; Saelens et al 2003; Frank 2000b). Recruitment of participants included an over-sampling in more walkable locations to ensure a statistically significant sample of households within a range of different types of urban environments. This over sampling of higher density environments supported the project's goal of inclusion of minority participants within the study and resulted in a representative sample by ethnicity.

Dependent measures of body mass index, objectively assessed physical activity levels, self reported travel patterns and activity patterns were collected. Criteria air pollutants resulting from reported vehicular travel were subsequently modeled. Body mass index was obtained for all of the travel survey participants above 15 years of age. Accelerometers were deployed on 524 participants to objectively assess physical activity as part of the physical activity sub-survey shown in figure 1 (Frank et al 2004b). Travel and activity patterns were obtained over a two-day period through a diary and then retrieved via a computer aided telephone interview. Emissions modeling was conducted on over 100,000 trips using regional travel demand model data on network performance to capture vehicle speeds based on the assumed routes and times of travel. Demographic data was obtained during recruitment via a computer-aided telephone interview.

Independent measures of the built environment were developed in a Geographic Information System (GIS). Individual measures of urban form were calculated for the region as a whole as shown in Figure 3 (left panel) and for each participant's place of residence (right panel). Discrete measures of net residential density, mixed use, street connectivity and regional accessibility to employment were calculated and tested within a cross sectional research design as predictors of the outcome measures noted above when controlling for socio-demographic factors and relative travel times across available modes of travel. More information on the procedures used to develop these measures is provided in project documentation. Figure 3 (left panel) illustrates a walkability surface or index for the region based on the combined effect of several measures of walkability.

An index has several advantages over using individual measures of urban form in predicting behavior including a high degree of spatial multi-collinearity between urban form measures (Frank et al 2000a). However, research presented here documents that it is not always possible to use a walkability index as a predictor of physical activity or of obesity. This is particularly the case if one or more of the component measures of walkability are not related with a particular outcome variable. The premise being that a truly walkable environment requires each of these, and several other components including supportive pedestrian infrastructure along block faces and at intersections. Many areas of our sprawling suburbs are dense and mixed use, but provide

little in the way of pedestrian connectivity (Moudon et al 1996). Such places are difficult to traverse even short “crow-fly” distances on foot.

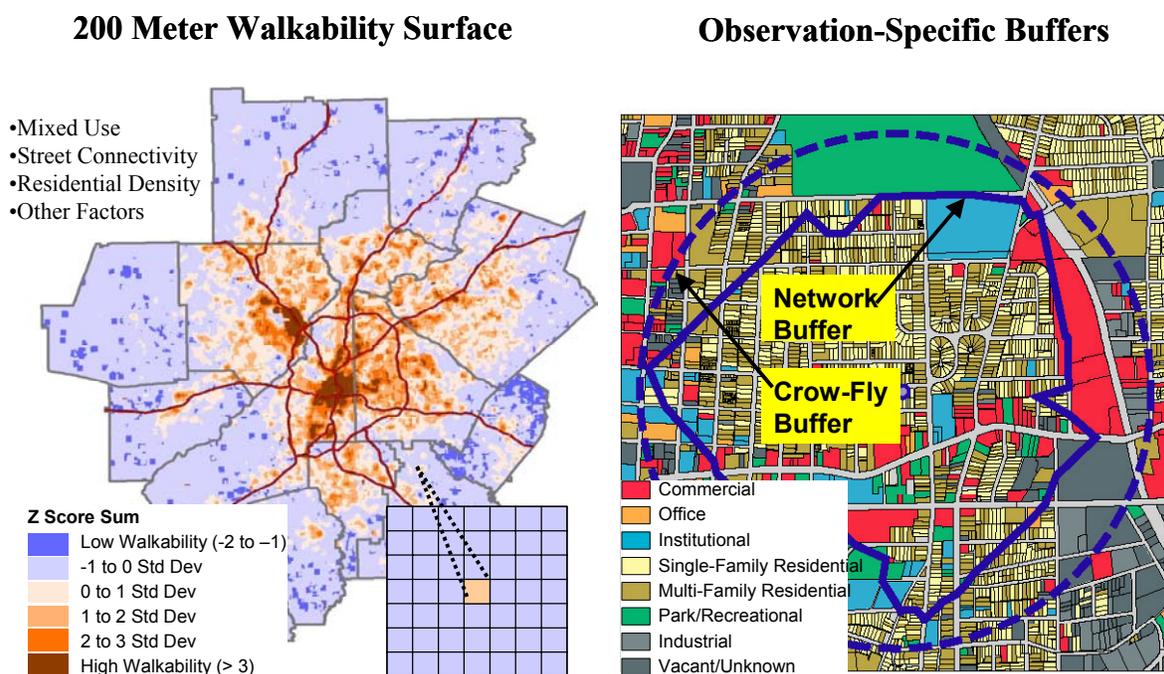


Figure 3 – Measuring Urban Form in the Atlanta Region

Conclusion

Findings are presented on analyses testing relationships between urban form and objective measures of physical activity; between urban form, self-reported activity patterns, and body mass index and obesity; and between urban form, self reported travel patterns, and air pollution. Results in each of these analyses confirm important relationships between community design and direct and indirect predictors of health and quality of life. Moreover, the results suggest important synergies between strategies that would promote physical activity, weight loss, and potentially improve respiratory function. Important areas of future research include:

- Impacts of pedestrian features along block faces including sidewalk presence, completeness, and placement, building facades and design details, street trees, and many other features on the walking and of design alternatives at intersections on the real and perceived safety;
- Impacts of urban form and pedestrian environmental attributes on transportation related physical activity for youth, elderly, and across gender and ethnicity;
- Assessment of the impacts of urban design attributes, including scale, uses, and sightlines on the perception of travel distance;
- Detailed assessment of the intra-regional variation in air toxics and small particulate matter and the ability to offset increased levels of these pollutants in walkable centers where growth would be focused to promote physical activity (Frank and Engelke 2004c);
- Systematic assessment of the variation in food environments
- Assessment of the demand relative to the supply of walkable environments (Levine and Frank, 2004)
- Assessment of the effect of self-selection of community environments on physical activity patterns; and
- Relationships between transit use, auto ownership, walking and biking.

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